

WE CLAIM:

1 1. A chemical vapor deposition (CVD) method for forming a compound comprising Ta
2 and N, comprising the steps of:

3 using an alkylimidotris(dialkylamido)Ta species for Ta precursor; and
4 providing a precursor supplying nitrogen.

1 2. The method of claim 1, further comprising the step of selecting
2 tertiaryamylimidotris(dimethylamido)Ta as said alkylimidotris(dialkylamido)Ta species.

1 3. The method of claim 1, further comprising the step of selecting ammonia for said
2 precursor supplying nitrogen.

1 4. The method of claim 1, further comprising the step of selecting said compound from
2 the group consisting of TaN and TaSiN.

1 5. The method of claim 4, further comprising the step of selecting the N to Ta elemental
2 ratio in said compound to be greater than about 0.9.

1 6. The method of claim 4, further comprising the step of selecting a Si precursor for said
2 TaSiN from the group consisting of silane and disilane.

1 7. The method of claim 1, further comprising the step of using hydrogen for carrier gas.

1 8. A semiconductor field effect device having a gate dielectric and a gate, wherein said
2 gate comprises a compound comprising Ta and N disposed over said gate dielectric,
3 wherein said compound has a resistivity below about $20\text{m}\Omega\text{cm}$, and wherein in said
4 compound the elemental ratio of N to Ta is greater than about 0.9.

1 9. The field effect device of claim 8, wherein said compound is TaN or TaSiN.

1 10. The field effect device of claim 9, wherein in said TaN the N to Ta elemental ratio is
2 between about 0.9 and 1.1.

1 11. The field effect device of claim 10, wherein said TaN has a crystalline material
2 structure.

1 12. The field effect device of claim 9, wherein in said TaSiN the Si to Ta elemental ratio
2 is between about 0.35 and 0.5.

1 13. The field effect device of claim 12, wherein said TaSiN has an substantially
2 amorphous material structure.

1 14. The field effect device of claim 9, wherein said TaSiN has a workfunction which
2 equals an n-doped Si workfunction within about 300mV.

1 15. The field effect device of claim 8, wherein said gate dielectric has an equivalent oxide
2 thickness of less than about 5nm.

1 16. The field effect device of claim 15, wherein said gate dielectric has an equivalent
2 oxide thickness of less than about 2nm.

1 17. The field effect device of claim 8, wherein said gate dielectric comprises SiO₂.

1 18. The field effect device of claim 8, wherein said gate dielectric comprises a high-k
2 dielectric material.

1 19. The field effect device of claim 8, wherein said device is a Si based MOS transistor.

1 20. The field effect device of claim 19, wherein said device is an NMOS transistor.

1 21. The field effect device of claim 20, wherein said NMOS transistor has a threshold
2 voltage between about 0.15V and 0.55V.

1 22. A method for fabricating a semiconductor field effect device which has a gate
2 dielectric, comprising the step of depositing onto said gate dielectric a compound
3 comprising Ta and N by using chemical vapor deposition (CVD) with an
4 alkylimidotris(dialkylamido)Ta species for Ta precursor.

1 23. The method of claim 22, further comprising the step of selecting said compound with
2 a resistivity below about $20\text{m}\Omega\text{cm}$.

1 24. The method of claim 22, further comprising the step of selecting in said compound
2 the elemental ratio of N to Ta to be greater than about 0.9.

1 25. The method of claim 22, further comprising the step of selecting said compound from
2 the group consisting of TaN and TaSiN.

1 26. The method of claim 25, further comprising the step of selecting the N to Ta
2 elemental ratio in said TaN to be between about 0.9 and 1.1.

1 27. The method of claim 25, further comprising the step of selecting the Si to Ta
2 elemental ratio in said TaSiN to be between about 0.35 and 0.5.

1 28. The method of claim 22, further comprising the step of selecting
2 tertiaryamylimidotris(dimethylamido)Ta as said alkylimidotris(dialkylamido)Ta species.

1 29. The method of claim 22, further comprising the step of heating said compound up to
2 about 1000°C.

1 30. The method of claim 22, further comprising the step of providing a source and a
2 drain, wherein the step of depositing said compound is carried out before the step of
3 providing said source and said drain.

1 31. The method of claim 22, further comprising the step of providing a source and a
2 drain, wherein the step of depositing said compound is carried out after the step of
3 providing said source and said drain.

1 32. The method of claim 22, wherein said step of depositing is carried out conformally
2 onto a patterned surface.

1 33. A processor, comprising:
2 at least one chip, wherein said chip comprises at least one semiconductor field
3 effect device having a gate dielectric and a gate, wherein said gate comprises a compound
4 comprising Ta and N disposed over said gate dielectric, wherein said compound has a

1 resistivity below about $20\text{m}\Omega\text{cm}$, and wherein in said compound the elemental ratio of N
2 to Ta is greater than about 0.9.

1 34. The processor of claim 33, wherein said processor is a digital processor.

1 35. The processor of claim 33, wherein said processor comprises at least one analog
2 circuit.